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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
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CHICAGO, IL 60604-3590

Date: September 27, 2005

Subject: Results of Investigations at the
Ellsworth Industrial Site
Downers Grove, IL
September 2003 and October 2004

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Mazin:

As you know, the USEPA has been doing some additional hydrogeologic characterization in the vicinity of the Ellsworth Industrial site (the site) now that most of the residential-supply wells in the area have been taken off line and the majority of the residences are on municipal water. This characterization supplements the hydrogeologic characterization done during the summer of 2003, prior to the switch to municipal water. Our most recent hydrogeologic characterization took two forms, geophysical logging in select residential-supply wells, and a round of water-level measurements in most of the available monitoring wells and select residential supply wells in the study area (tables 1 and 2). The study area is considered to encompass the site and the surrounding area where the water-supply wells are present. As you know, there are essentially two hydrogeologic units of concern to these investigations. The uppermost hydrogeologic unit is the glacial-drift deposits, which are composed of a mixture of coarse grained (sand and gravel) aquifers and fine grained (silt and clay or till) confining units. Underlying the glacial-drift deposits is the shallow bedrock, which is composed of fractured dolomite of Silurian age.

SUMMARY

- Water levels in wells open to the drift aquifer indicate downward vertical flow but no consistent horizontal direction. Water levels in the drift aquifer do not appear to be useable for determining horizontal flow directions, even when the wells are restricted to specific altitudes.
- The direction of ground-water flow in the bedrock aquifer is from northwest to southeast.
- The direction of ground-water flow in the bedrock aquifer does not appear to have been

altered by the cessation of pumping from the residential wells in the area.

- Fractures in the bedrock deposits appear to be concentrated at certain altitudes, but there is no indication of fractures at a specific altitude throughout the residential area.

WATER LEVEL MEASUREMENTS:

September 2003 Data

We were able to get the data that Lockformer measured from their bedrock wells during the same time as our measurements on September 22-23, 2003. Combination of their measurements and our measurements for the bedrock wells (figs. 1, 2; table 3) indicates flow in the bedrock aquifer is from northwest to southeast, an interpretation that is consistent with previous measurements and the location of the VOC plume as defined by the sampling in the residential wells. Changes in water levels were fairly small across the area, varying from 652.85 ft on the northern part of the Lockformer property at well MW1106D to 646.95 ft near 63rd Street at well RW13, a change of about 6 ft over a distance of about 2.5 miles. This data is consistent with several other indicates that the bedrock aquifer is capable of quickly transmitting water (and contaminants).

Water levels in the municipal wells, the Katrine well for example, are substantially lower than in the nearby monitoring wells, indicating that water levels in the deeper part of the bedrock are lower than in the upper part. It is possible, therefore, that municipal wells located within the boundaries of the plume (such as the Katrine well) have been providing conduits for contaminant migration from the upper, contaminated, part of the bedrock aquifer to deeper, (presumably) uncontaminated parts. It is my understanding the municipal wells are now abandoned and this migration route should no longer be open. However, you should probably verify this assumption with the village.

October 2004 Data

Water-level measurements taken from monitoring wells open to the glacial-drift deposits on October 12, 2004 (table 1) vary with depth across the site, being higher in shallower wells and lower in deeper wells. Water levels in the drift wells as a group do not show a consistent trend across the site (figure 3). Water levels in wells open at about 644 feet above sea level (fasl) range from about 650-660 fasl and exceed 555 fasl in wells BD5I and 7I located in the southeastern part of the Ellsworth Industrial Park as well as in wells BD4I, DG2I, and DG-1D near the Downers Grove Sanitary District (DGSD) sludge lagoons. Water levels in wells open to the drift deposits at about 644 fasl are less than 651 ft in wells OV6I, BD6I and 8I nearer to the center of the industrial park as well as in wells DG-4I and LD-1I south of the DGSD sludge lagoons. Accounting for differences in the wells that were measured, water-level trends in the drift wells generally are consistent with those identified during the September 2003 measurements. However, water levels in drift wells open at about 644 fasl also do not show a consistent trend across the site and the utility of interpreting horizontal flow directions from these wells is uncertain. For what it's worth, water levels appear to indicate flow in a west to northwest direction in the eastern part of the site and in a south to southwest direction near the DGSD lagoons.

Water levels in the drift wells varied by less than 1 ft between the September 2003 and October 2004 measurement events. Water levels in October 2004 were about 0.7 ft higher than in September 2003 in wells BD5I, BD6I, BD7I and BD8I and were about 0.50 ft lower in well

BD4I. These differences can be attributed to natural variations in recharge from precipitation.

Water levels in the wells open to the bedrock aquifer during October 2004 ranged from about 743.6-752 ftasl (figure 1), with water levels beneath most of the area being between about 651 and 647 ftasl. As was the case during September 2003, these changes represent a low horizontal hydraulic gradient (about 5.2×10^{-4} ft/ft) across the study area, which is indicative of a permeable aquifer. Water levels in the bedrock aquifer showed an overall decline from north to south, being about 656 feet above sea level at RW6 in the northern part of the study area and about 646 ft at RW3 in the southwestern part of the study area and 643.6 ft at RW29 in the southeastern part. These trends in water levels generally are similar to those measured in September 2003, but the 2004 water levels show more consistent variations across the study area, presumably because of the cessation of pumping and the more accurate measurements that could be taken from the residential wells after the pumps were removed. Apparently localized, anomalous, high water levels were measured in the southern part of the study area at wells RW12, RW15, and RW35. These high water levels are likely to be affected by the degree of hydraulic connection with the overlying drift deposits and the integrity of the well seal.

Beneath the site itself, trends in water levels in the upper bedrock wells are consistent with those measured in September 2003 and indicate that flow directions are complex. Apparently anomalous, localized, high water levels were detected in wells BD14D and BD5D (fig. 2). The cause of these high water levels is unclear, but are likely to be affected by changes in the altitude of the bedrock surface and the degree of hydraulic connections with the overlying drift deposits.

Water levels in the monitoring wells open to the bedrock varied by less than 1 ft between the September 2003 and October 2004 measurement events (table 1). Water levels in all of the bedrock monitoring wells were about 0.5 to 0.8 ft higher October 2004 than in September 2003. These changes are consistent with the direction and magnitude of the changes in the drift wells, indicating that they are due to natural variations in recharge from precipitation. Water levels in the residential wells open to the bedrock varied by about 0.4 to 5.4 ft between the September 2003 and October 2004 measurement events, with water levels in all but one of these wells being higher in 2004 (table 2). The wells with the differences in excess of 1 ft typically were in the area of intensive aquifer pumping south of Maple Ave. These changes are likely to be due to a combination of natural fluctuations in water levels, the short-term effect of pumping from nearby wells during the 2003 measurements, and the long-term effect of the cessation of pumping from most of the aquifer before the 2004 measurements.

Water-level data indicate that provision of an alternate water supply to the residences in the study area, and the resulting cessation of pumping from the bedrock aquifer, has had minimal impact on the direction of flow in this aquifer. Although we did not collect water-quality data as part of this effort, the water-level data do not indicate that the direction of contaminant movement through the bedrock aquifer will be substantially affected by the cessation of pumping. This data indicates that homes in the study area that are outside of the historical boundaries of the contaminant plume but continue to be supplied from the bedrock aquifer do not appear to be in imminent danger of contamination.

It is noted, however, that a number of households in the study area southwest of the Interstate and Maple Ave. continue to rely on the bedrock aquifer for water supply and that many of these households are hydraulically downgradient (or at least sidegradient) of contaminated parts of the aquifer. One of these households appears to be supplied by well RW13 (RW13 did not appear to have been abandoned as of the 2004 measurement, you may want to check the status of this well). Furthermore, although the water-level data indicate that the direction of contaminant movement through the aquifer appears unlikely to change, the absence of pumping from the aquifer means that a large volume of contaminated water that was being removed from the aquifer on a daily basis (average per household water use in this area probably is about 260 gallons per day) is now remaining in the aquifer, potentially resulting in an increase in the size of the plume, if not necessarily its direction of movement. Finally, these measurements represent water levels in response to the hydraulic stresses that were operating during the periods of investigation. If conditions were to change, due to an prolonged drought or the resumption or initiation of high-capacity pumping in the study area, it is likely that water levels in the aquifer also would change. In short, while there does not appear to be immediate cause for concern, the situation in the aquifer still bears further investigation designed to predict, or at least monitor, the extent of the plume in the future.

GEOPHYSICAL LOGGING:

Geophysical logging was performed by the USEPA Region 5 in wells RW8, RW9, RW2, RW7, RW21, RW22, and RW20 after the pumps had been removed from the wells. Geophysical logs consisted of natural gamma, caliper, fluid resistivity, spontaneous potential, temperature, ground conductivity, normal resistivity, fluid conductivity, dissolved oxygen concentration, oxidation-reduction potential, nitrate concentration, ammonia concentration, and chloride concentration. All logs were not run in all wells. Ammonia, nitrate, chloride, dissolved oxygen, and oxidation-reduction potential (redox) logs (collectively called water-quality logs in this memo) typically did not show good agreement between runs and are not relied upon in the interpretations.

RW8: Natural-gamma logs for well RW8 indicate generally decreasing clay content in the unconsolidated deposits from the land surface to the top of the bedrock, with sand or sand-and-gravel deposits indicated below a depth of about 65 ft (altitude about 675 fasl). The well casing ends at 100 ft (640 fasl), which is presumed to correspond to the location of the top of the bedrock. The bedrock deposits are nonargillaceous dolomite. Caliper logs indicate large fractures in the dolomite bedrock at depths of about 104 and 108 ft (altitude about 635 and 631 fasl). Temperature, fluid resistivity, and fluid conductivity logs indicate inflow of water to the borehole from below the well casing at about 100 ft (639 fasl) to the vicinity of the 3-4 inch deep fractures at about 104 ft (635 fasl). Oxidation-reduction potential and nitrate logs were variable and were inconsistent between runs, but tended to show changes that may have been associated with flow at about 108 ft (631 fasl). Normal resistivity and ground conductivity logs indicate generally increasing competence to the dolomite with depth to about 116 ft (623 fasl) and thereafter tends to retain similar values to the bottom of the hole.

RW9: caliper logs for well RW9 indicate numerous 0.5-0.8 inch deep fractures in the dolomite bedrock from the bottom of the well casing at 97 ft to about 114 ft (altitude about 616 and 633 fasl) and at 142 ft (588 fasl). Ground conductivity logs indicate a high conductivity between 110

and 115 ft (610-615 fasl), which is consistent with a change in water quality in this interval. Temperature, fluid conductivity, and water quality logs indicate gradual change in the character of the water from the well casing to about 115 ft (615 to 633 fasl) and another gradual change from about 115 to about 142 ft. These changes are difficult to interpret with certainty, but may be indicative of inflow of water from at least some of the fractures in this interval. Some logs also show a fairly sharp deflection in temperature and dissolved oxygen near 114 ft (616 fasl). There also is a repeatable deflection in the temperature and dissolved oxygen logs associated with the fracture detected at about 142 ft (588 fasl), which is indicative of flow.

RW2: Natural-gamma logs for well RW2 indicate generally decreasing clay content in the unconsolidated deposits from the land surface to the top of the bedrock, with sand or sand-and-gravel deposits indicated below about 75 ft (685 fasl). The bedrock deposits generally are nonargillaceous dolomite and are present below the bottom of the well casing at 128 ft (632 fasl). Caliper logs indicate numerous discrete fractures with the largest ones (about 0.5 inches deep) at about 157 and 170 ft (altitude about 590 and 603 fasl). Temperature logs indicate inflow of water to the borehole from below the well casing at about 128-135 ft (635-642 fasl) to the vicinity of the fracture at about 170 ft (590 fasl). The remaining water-quality logs indicate flow in the upper few feet of the aquifer beneath the casing and generally consistent concentrations of nitrate and chloride with depth below the well casing. Normal resistivity logs indicate no clear change in competence to the dolomite with depth.

RW7: Natural-gamma logs for well RW7 indicate generally decreasing clay content in the unconsolidated deposits from the land surface to the top of the bedrock, with sand-and-gravel deposits indicated below about 105 ft (666 fasl). The bedrock deposits are nonargillaceous dolomite. Caliper logs do not indicate discrete fractures, but rather a widening of the borehole below the well casing at about 148 ft (altitude about 582 fasl). The caliper log also indicates that the interior of the well casing is considerably more irregular than normal, especially at the bottom of the casing. Temperature, fluid resistivity, and fluid conductivity logs showed no clear, repeatable, deflections indicative of flow in the interval below the casing. The other water-quality logs show discrete deflections in certain intervals below the casing, but these deflections were not repeatable, indicating they are due to fluctuations in the logging tool.

RW20: Lithologic logs indicate the casing of this well extends to the top of the bedrock at 115 ft (639 fasl). However, caliper logs indicate the casing ends at about 105 ft (649 fasl), with a "wash out" characteristic of fractured rock from about 105-113 ft (641-649 fasl). Only about 20 ft of the aquifer was logged at this well. Fluid conductivity logs show a slight increase from about 106 to about 116 ft (638 to 648 fasl), potentially indicating flow in this interval.

RW21: Caliper logs indicate casing above 112 ft (altitude 640 fasl) and fractures more than ½ inch deep from 120-125, (altitude about 627-632 fasl), 140 (altitude about 586 fasl), and 144 ft (altitude about 582 fasl). No other logs were attempted in this well due to concerns about tool safety.

RW22: Natural-gamma logs for well RW22 indicate generally decreasing clay content in the unconsolidated deposits from the land surface to the top of the bedrock, with sand or sand-and-gravel deposits indicated below about 96 ft (669 fasl). The bedrock deposits generally are

nonargillaceous dolomite described as beginning at 110 ft (655 fasl). The casing ends at 110 ft according to the lithologic log, and 120 ft according to the caliper log. Caliper logs indicate discrete fractures at about 132, 164, and 172 ft (altitude about 633, 601, and 593 fasl, respectively). Temperature, conductivity, and/or fluid resistivity logs indicate inflow of water to the borehole from below the well casing to about 125-130 ft (635-640 fasl) and flow associated with the fractures at 164 ft (601 fasl) and 172 ft (593 fasl), as well as a small fracture identified by the caliper log at about 148 ft (617 fasl). The remaining water-quality logs may indicate increased concentrations of ammonia and chloride with depth as well as an increase in the ORP as well as flow associated with features at 124 and 132 ft (641 and 633 fasl, respectively). The large spikes on the redox, ammonia, and chloride logs at about 163, 171, 181, and 186, and perhaps smaller spikes at shallower depths, appear to be spurious. Normal resistivity logs indicate that the dolomite at about 134-142 ft (635-623 fasl) is more competent than the rest of the bedrock, that competence tends to increase below 172 ft (593 fasl), and that a conductive feature is present at about 124 ft (641 fasl).

Lithologic interpretations drawn from analysis of the geophysical logs are consistent with those made from the analysis of the lithologic logs. The geology beneath most of the site consists of two separate units, the glacial drift and the bedrock. The glacial drift can be subdivided into an upper unit, composed primarily of fine grained argillaceous materials, and a deeper unit composed of more permeable sands and gravels. The sand and gravel deposits are the most likely pathways for ground-water flow and contaminant migration in the drift deposits beneath the study area. The geophysical logs indicate permeable fractures (or some other type of secondary permeability feature) in the dolomite bedrock at about 582, 588-593, 603, 627-635, and 641 fasl in two or more wells. The interval from about 627 to 635 fasl appears to be associated with features created by weathering of the bedrock surface and is present at most of the wells. These altitudes, particularly above 627 fasl, would be expected to be moving ground water, and contaminants in ground water, through the bedrock and should be considered for targeting as the screened intervals for new wells to be installed for the long-term monitoring.

If you have any questions or comments feel free to call me at 6-7938.

cc. S. Padavoni